# How to Calculate the Visible Energy of an Event (Work in Progress)

Emily Maher

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## Motivation

For my cross section measurement, I will use the electron neutrino events to calculate the tau neutrino cross section. As a check, I will assume the tau neutrino cross section is equal to the electron neutrino cross section and use the energy distribution of the electron events to predict the energy distribution of the tau events. I will then compare this predicted distribution to the actual distribution.

To do this, I need a general method of measuring the visual energy of both electromagnetic and hadronic events.

# Possible Tools

- sfenergy.sf - this is a routine Reinhard wrote to estimate the total visible energy using the SFT. He provides two estimates for this energy - one assuming the event is electromagnetic and the other assuming the event is hadronic

- emcal_com.inc/emanal.sf - which I believe are the routines Byron used to estimate the energy in the EMCAL

I can use these to estimate the energy and compare to Monte Carlo.

# Problems I Have Encountered

- From MC, I can (so far) only find the energy of the neutrino and the energy of the primary lepton. I have estimates for the visible energy of the event.

  - For muon cc events, I can subtract the true muon energy from the true neutrino energy and compare to the estimate of visible hadronic energy.

  - For electron cc events, it is more complicated. I will compare the estimates to both the true neutrino energy and the true electron energy.

- I do not have emanal.sf running yet.

# Preliminary Results

### Estimate of Visible Energy vs. True Electron Energy
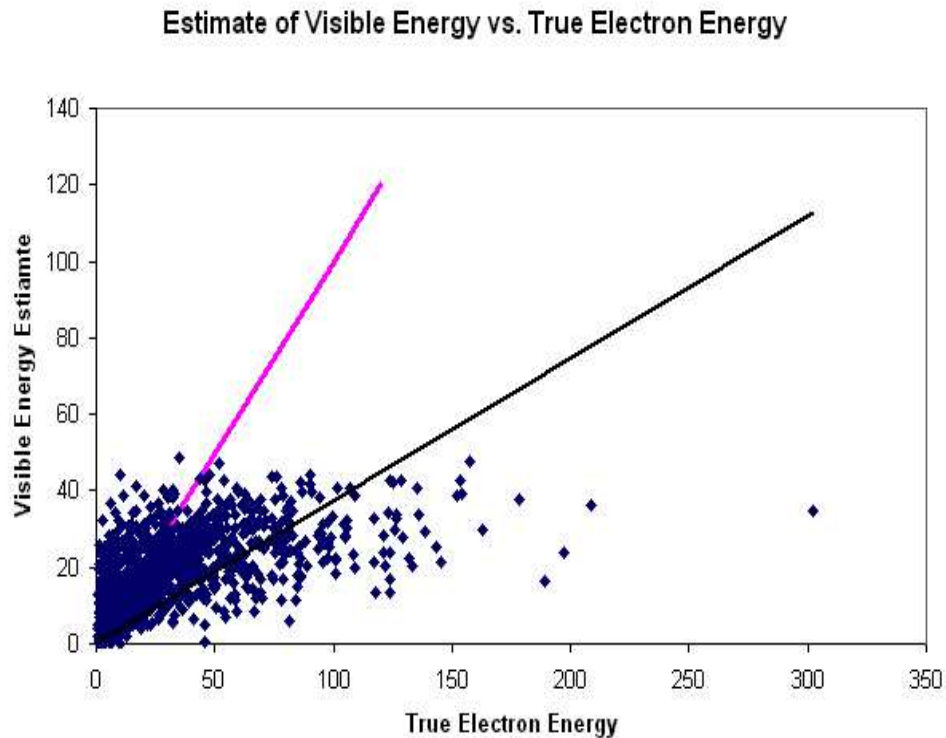


This is a plot of the total electromagnetic energy estimate vs the true electron energy for 1000 Monte Carlo events. The pink is $y = x$, and the black is the fit, which is $y = 0.37x$. There are outlying points which seem to bring the fit down. I have posted pictures of three of these events in the Emily folder.

**Visible Energy Estimate vs True Neutrino Energy**
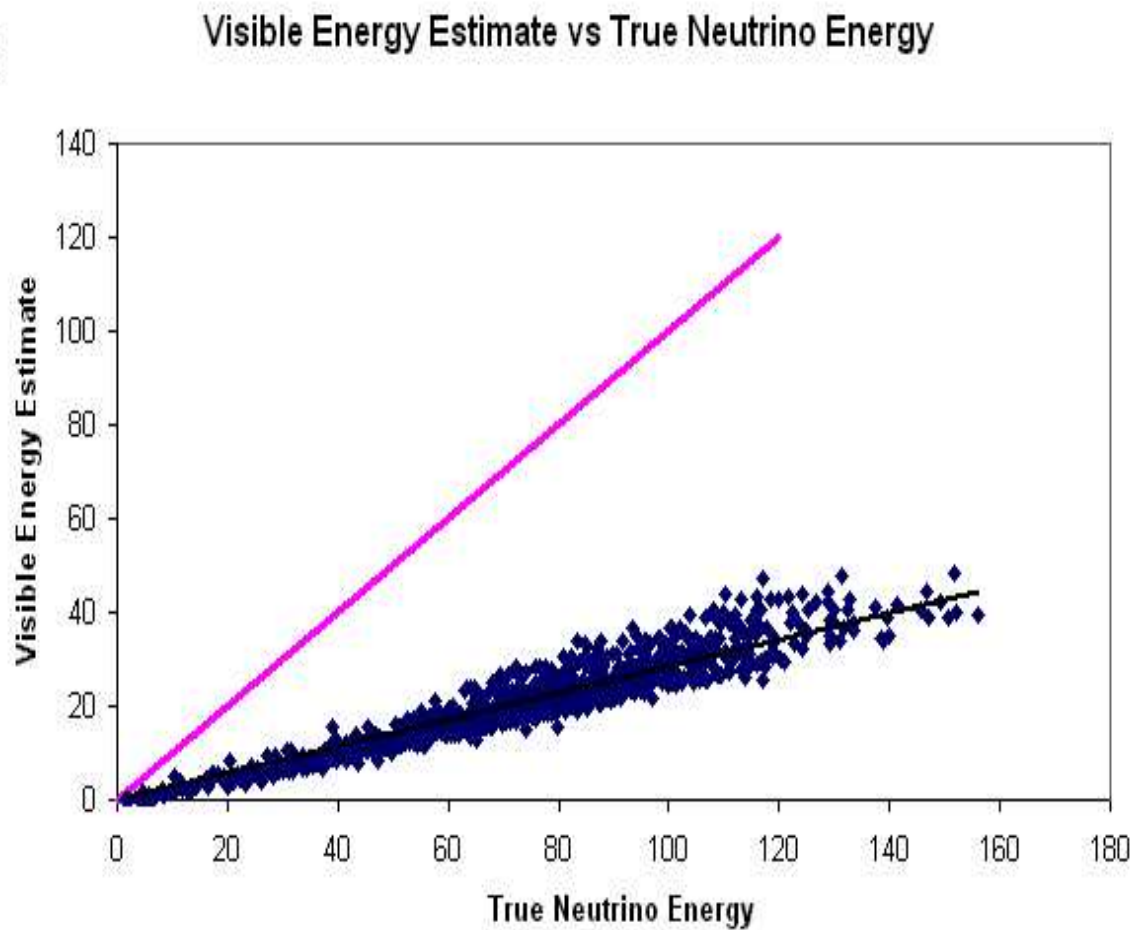
This is a plot of the true neutrino energy vs the electromagnetic energy estimate for the same events. Again the pink is $y = x$, and the black is the fit, which is $y = 0.0.28x$.

Future Work

- Complete same type of analysis for muon cc events

- Get emanal.sf running and compare its estimates to sfenergy and Monte Carlo

- Investigate the outlying points further